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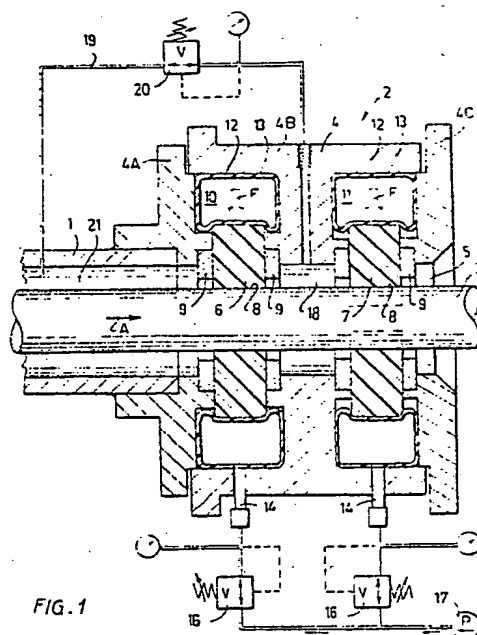
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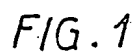
(54) Seals

(57) A sealing head 2 for a pressurized treatment tube 1, such as a vulcanizing tube, for a cable 3 or similar elongated product comprises a housing 4 for fastening to the tube 1 and containing two flexible seals 6, 7 mounted in tandem in the direction of movement of the cable through central openings 8 in said seals. The housing defines chambers 10, 11 surrounding the seals 6, 7 and connected separately to a pressure

medium source 17 whereby the openings 8 are adjustable in size by adjusting independently the pressures in the chambers and hence varying the radial compression force F. Thus the head 2 seals both against the pull rope for the cable and the coated cable so that the treatment tube may be pressurized at the very beginning of the treatment of the cable. An annular space 18 between the seals is adjustably connected to a second pressure medium supply, e.g. the interior of the treatment tube to provide a further seal.



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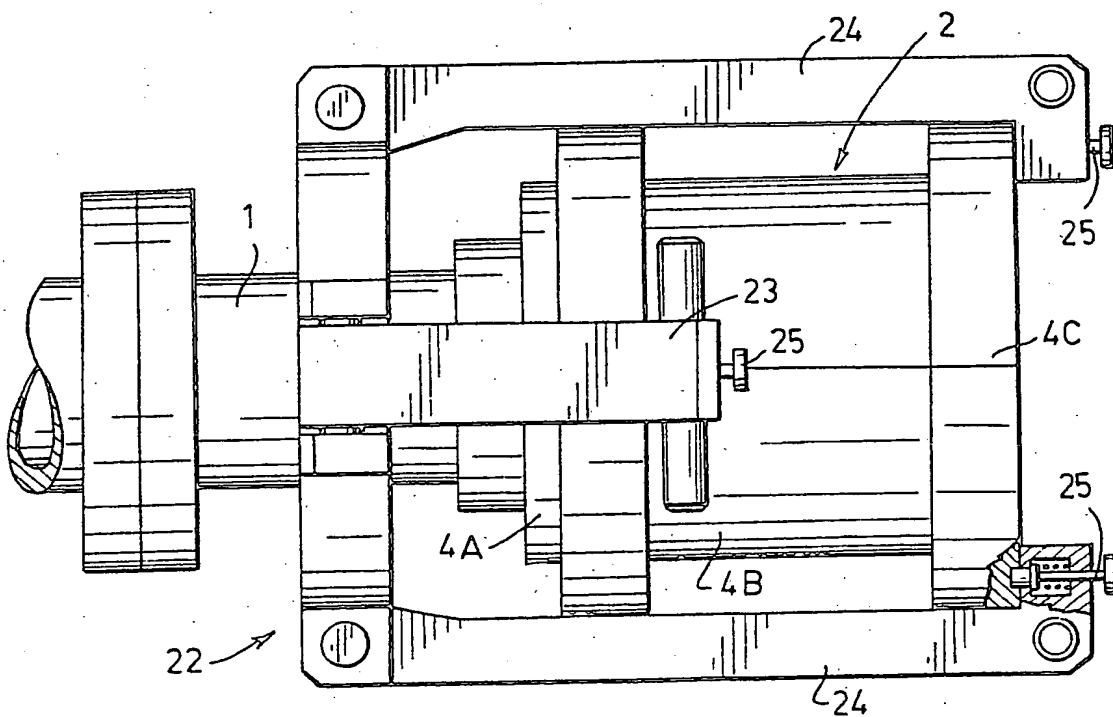
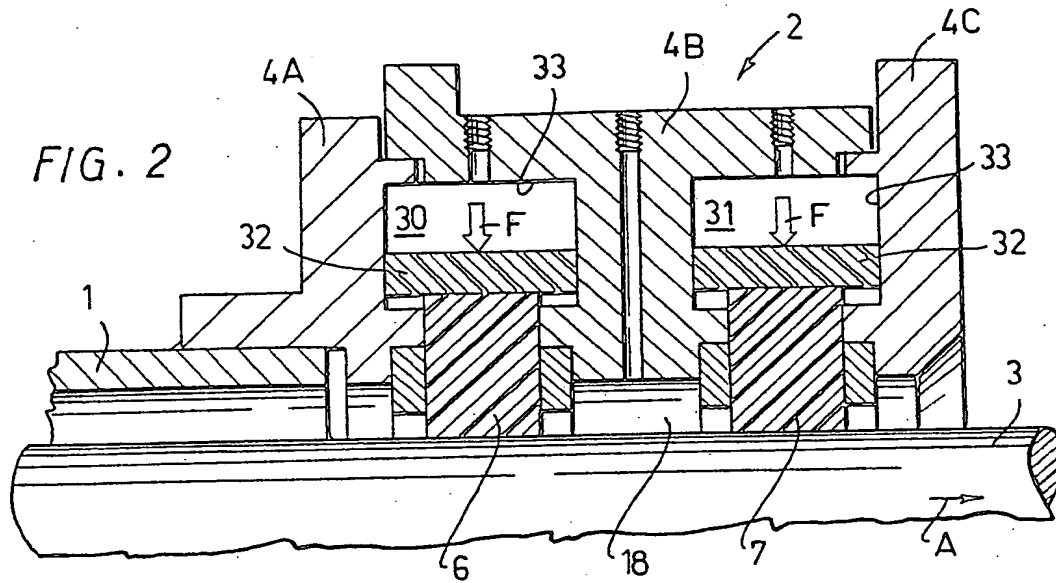


FIG. 3

SPECIFICATION

Sealing Head for a Treatment Tube for a Cable or Similar

This invention relates to a sealing head for a treatment tube subjected to an internal pressure for a cable or similar elongated product, comprising a housing to be fastened to the end of the treatment tube, a flexible seal mounted in said housing and provided with a central opening for the passage of the cable, and a closed adjusting chamber provided in said housing and surrounding said seal, said chamber being adjustably connected to a pressure medium source for subjecting said adjusting chamber to pressure medium and for applying a radial compressive force to the outer periphery of said seal in order to adjust the size of the opening thereof.

For example, when vulcanizing an extruded insulation coating of an electric cable, the cable is passed axially through a treatment tube the inner space whereof is filled with a pressurized gas or liquid. For closing the pressurized inner space of the treatment tube, the end of the tube is provided with a sealing head of the above described type, the treated cable passing through a seal in said head.

It has been previously proposed to use in a sealing head a conical seal, whereby the diameter of a central opening provided in said seal, i.e. the tightness of the seal against the mantle surface of the coating of the cable passing through it, is adjusted by compressing the conical portion of the seal in the axial direction by means of a metallic ring of a corresponding shape. The required compression is obtained by means of pneumatic cylinders and a threaded bushing which limits the compression of the cylinders. The adjustment is cumbersome and remote adjustment is difficult to arrange. Also the seal cannot be replaced during the vulcanizing process.

From German Offenlegungsschrift 2 304 515 it is previously known to compress radially the conical portion of a seal by means of a flexible annular hose surrounding the conical portion, the outer periphery of said hose abutting a fixed support and the inner space of said hose being connected to a pressure medium supply for expanding the hose.

As the vulcanizing tube must be pressurized while the coating of the cable passing therethrough is being vulcanized, the outlet end of the vulcanizing tube must be sealed by means of the sealing head before the vulcanization can be started. As the coated cable must be allowed to pass through the seal of the sealing head, the seal must be substantially adapted to the size of the mantle surface of the coating of the coated cable. The junction or joint between the pull rope by means of which the cable is at first pulled through the vulcanizing tube and the cable is, however, so inaccurate and irregular on its surface that the passage of the joint through the seal causes

leakage and, accordingly, a harmful pressure reduction in the vulcanizing tube. When using known sealing heads for sealing the vulcanizing tube, it has therefore been possible to start the vulcanization only after the coated cable has reached the sealing head. This results in a substantial loss as the unvulcanized first portion of the coated cable must be rejected. As the length of the treatment tube may be as much as 100 m, it is obvious that the rejection of a cable portion of a corresponding length is very uneconomical, especially in the case of high voltage power cables of a large diameter.

It is an object of this invention to provide a sealing head which eliminated the above mentioned disadvantages and makes it possible to seal the treatment tube and to maintain the seal in spite of the passage of the joint between the pull rope and the cable. A further object of the invention is to provide a sealing head allowing the replacement of the seal during the passage of the cable. This object is achieved by means of a sealing head according to the invention which is characterized in that at least two flexible sealing elements are mounted in said housing one after the other in the direction of movement of the cable and in that said housing is provided with a separate surrounding adjusting chamber for each sealing element, said adjusting chambers being separately adjustably connected to said pressure medium supply, whereby an annular chamber outwardly defined by said housing is formed between said sealing elements.

The invention is based on the cooperation of two sealing elements due to which, in the beginning of the cable treatment process, a seal is at first provided against a smooth-surfaced pull rope the outer diameter whereof is substantially equal to or slightly smaller than the outer diameter of the cable coating and, when the coated cable arrives at the sealing head, a seal against the cable coating without allowing pressurized gas or liquid in the treatment tube to leak from said tube when the joint between the pull rope and the cable passes through the sealing head. The inner diameter of the first sealing element in the direction of movement of the cable is thereby preferably adjusted by means of the pressure medium for the passage of the cable coating and the inner diameter of the next sealing element in the direction of movement is adjusted for the passage of the pull rope. After the leading end of the coated cable has reached the first sealing element, the inner diameter of the second sealing element is adjusted for the passage of the coating. The seal is, accordingly, first provided by the second sealing element, then by the first sealing element and thereafter by both elements. The pressurizable chamber defined by the housing between the seals ensures that the pressure inside the treatment tube cannot escape if the first sealing element does not yet provide a complete seal or if the passage of the joint between the pull rope and the cable causes leakage in the seals. The spacing of the seals in

the axial direction must be bigger than the joint between the pull rope and the cable.

The sealing head according to the invention thus permits sealing and pressurizing of the treatment tube and, accordingly, vulcanization of the cable coating right from the beginning of the extrusion of the coating.

By connecting the chamber between the sealing elements adjustably to a second pressure medium source, the medium pressure required for one sealing element can be reduced in the adjusting chamber by adjusting the pressure in the chamber between the sealing elements.

By assembling the sealing head from annular elements arranged axially one after another and each comprising two halves, it is possible to replace a sealing element during the treatment process by closing the preceding sealing element by means of a sufficient medium pressure in the corresponding adjusting chamber.

A planar sealing disc is easy and inexpensive to manufacture as it does not need to be manufactured in a mould contrary to profiled seals.

The invention will now be described in more detail with reference to the accompanying drawings where:

Figure 1 is an axial section of one embodiment of a sealing head according to the invention and of a portion of a treatment tube and a cable,

Figure 2 is an axial section of a second embodiment of a sealing head, and

Figure 3 is a top view of a locking device for the sealing head.

Figure 1 of the drawings illustrates a treatment tube 1 to which a sealing head 2 is fastened through which a treated cable 3 moves in the direction of the arrow A. The treatment tube may be a vulcanizing tube shown, for example, in U.S. Patent Publication 4 035 129.

The sealing head comprises a housing 4 which is provided with a central through-channel 5 and in which are mounted perpendicularly to the axis of the through-channel two axially spaced circular sealing discs 6 and 7 made of a flexible material. The sealing discs are provided with an opening 8 substantially corresponding to the cable diameter. The sealing discs are on both sides supported by annular supporting plates 9 mounted in the housing.

The housing is provided at each sealing disc with a closed adjusting chamber 10 and 11, respectively, surrounding annularly the outer periphery of said discs and in this case consisting of a flexible hose 12 fitting tightly into a corresponding casing 13 formed in the housing.

Each adjusting chamber is connected by means of a connector 14 and a conduit 15 through a pressure regulating valve 16 to a pressure medium source 17, in this case a pressure air source. In this way, the desired pressure may be produced in each adjusting chamber, said pressure applying through the hose on the outer periphery of the sealing disc a compressive force F compressing the sealing disc

radially. It will be noted that, by adjusting the pressures in the adjusting chambers, the tightness of the corresponding sealing disc in relation to the mantle surface of the coating of the cable may be adjusted.

The chamber 18 between the sealing discs is connected by means of a conduit 19 through a pressure regulating valve 20 to the inner space 21 of the treatment tube 1 so that the pressure acting in the chamber 18 can be adjusted, e.g., to one half of the pressure acting in the inner space of the treatment tube. In this way, the compressive force applied on each sealing disc may be reduced.

The embodiment shown in Figure 2 differs from the one shown in Figure 1 mainly with respect to the adjusting chambers 30 and 31, respectively, of the sealing discs. Said chambers consist in this case of annular closed chambers 33 formed in the housing. A cylindrical, flexible closed ring 32 is arranged in each chamber. Through this ring, the pressure acting in the adjusting chamber applies a radial compressing force F on the sealing disc. The ring 32 ensures the tightness of the sealing head against the pressure acting in the inner space of the treatment tube.

In the constructions shown in Figures 1 and 2, the housing 4 consists of separate elements 4A, 4B and 4C mounted axially one after the other, whereby the adjusting chambers 10, 11 and 30, 31, respectively, are each formed between two elements 4A and 4B, and 4B and 4C, respectively. The sealing head is provided with a locking device 22 provided with two pivotable locking arms 22 for the inner pair of elements 4A, 4B and two pivotable locking arms 24 for the outer pair of elements 4B, 4C. Reference numeral 25 denotes locking pins. Due to this, e.g., the outer pair of housing elements 4B, 4C may be opened for replacing the sealing disc 7 during the treatment process while closing the sealing disc 6 for the time of the replacement.

In order that the sealing discs 6, 7 and the supporting plate 9 be replaceable during the passage of the cable through the sealing head, the sealing discs are made each in two halves.

The drawings and the associated specification are only intended to illustrate the idea of the invention. In its details, the sealing head according to the invention may vary quite considerably within the frame of the claims. Instead of pressure air, pressure liquid may be used as pressure medium.

120 Claims

1. A sealing head for a treatment tube (1) subjected to an internal pressure for a cable or similar elongated product, comprising a housing (4) to be fastened to the end of the treatment tube, a flexible seal (6, 7) mounted in said housing and provided with a central opening (8) for the passage of the cable (3), and a closed adjusting chamber (10, 11; 30, 31) provided in said housing and surrounding said seal (6, 7) said

chamber being adjustably connected to a pressure medium source (17) for subjecting said adjusting chamber to pressure medium and for applying a radial compressive force (F) to the outer periphery of said seal in order to adjust the size of the opening thereof, characterized in that at least two flexible sealing elements (6, 7) are mounted in said housing (4) one after the other in the direction of movement (A) of the cable (1) and in that said housing (1) is provided with a separate surrounding adjusting chamber (10, 11; 30, 31) for each sealing element, said adjusting chambers being separately adjustably connected to said pressure medium supply (17), whereby an annular chamber (18) outwardly defined by said housing is formed between said sealing elements.

2. A sealing head according to claim 1, characterized in that said chamber (18) between said sealing elements (6, 7) is adjustably connected (19) to a second pressure medium supply (21).

3. A sealing head according to claim 1 or 2, characterized in that said housing (4) consists of annular elements (4A, 4B, 4C) positioned axially

one after the other, said elements in pairs enclosing between themselves one of said sealing elements (6, 7) and the corresponding adjusting chamber (10, 11; 30, 31), and in that said housing is provided with separate locking means (23, 24) for each pair of elements for releasable connection of both elements (4A, 4B and 4B, 4C, respectively).

4. A sealing head according to claim 3, characterized in that said sealing elements are annular sealing discs (6, 7) and in that annular supporting plates (9) are mounted in said housing (4) on opposite sides of said sealing disc (6, 7).

5. A sealing head according to claim 4, characterized in that said sealing discs (6, 7) and supporting plates (9) consist each of two halves.

6. A sealing head substantially as hereinbefore described with reference to Figures 1 and 3 of the accompanying drawings.

7. A sealing head substantially as hereinbefore described with reference to Figures 2 and 3 of the accompanying drawings.

8. Any novel feature or combination of features described herein.